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ABSTRACT

This curriculum guide, one of 15 volumes written for field test use with educationally disadvantaged industrial education students needing additional instruction in the basic skill areas, deals with helping students develop basic mathematics skills while studying woodworking. Addressed in the individual units of the guide are the following topics: using a ruler, calculating the greatest number of cuts from hardboard, calculating frame length in cabinetmaking, figuring board footage, figuring the cost of hardwood lumber, figuring the cost of finishing materials, doing lattice multiplication, and using fractions and decimals in the wood shop. Each unit contains some or all of the following: a discussion of the major concepts of the technique being covered, instructions to the teacher concerning the use of the given technique, suggested related activities, student instructions, a student assignment, supplemental activities, and one or more worksheets. A basic skills checklist and a basic skills verification form are also provided to assist teachers in identifying those students who require additional help with basic skills. (MN)

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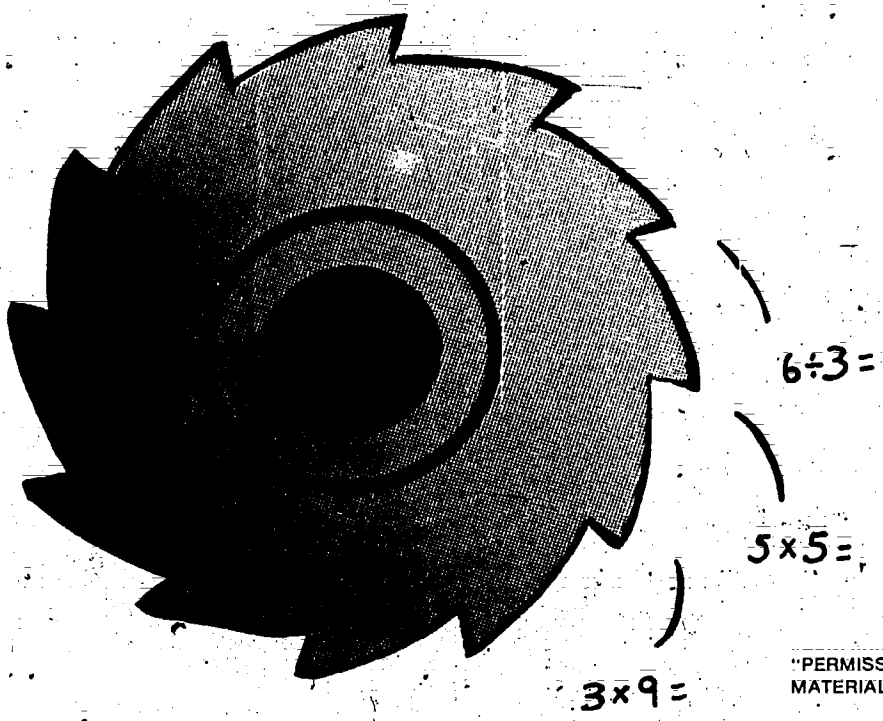
"LEARNING TO DO MATH THE WOODWORKING WAY"

ED244095



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INTRODUCTION

These instructional techniques were developed for those industrial education students who demonstrate a need for additional instruction in the areas of reading, writing, math, verbal and visual communication. They were written by industrial education teachers with a particular emphasis upon teaching a basic skill while retaining a major focus on the subject areas of auto, woods, metals, electronics, and drafting.

Each of these instructional techniques were written using the same format and with guidance from an expert in the areas of reading, writing, math, verbal and visual communication.

In order to help you identify those students who require additional help with the basic skills, a simple easy-to-use BASIC SKILLS CHECKLIST is provided with each subject area module. This Basic Skills Checklist will enable you as the Industrial Education Teacher to better identify those students in your classes who require additional help in the basic skills.

Additionally, a BASIC SKILLS VERIFICATION FORM is provided which will enable you to ask your school's reading resource teacher, basic skills teacher, math resource teacher, Hart Bill Conferencing teacher, or grade counselors, to verify your identification and provide you with help in the instruction of the basic skills.

You may wish to use these techniques as instruction for your entire class, or as a take-home, parent-involvement assignment. They may also be used in your school's reading or math lab or in conjunction with your school's basic skills instructional programs.

These instructional techniques are successful because your students are able to relate reading, writing, math, verbal and visual communication to their own industrial education classes. When your students succeed, they feel good about themselves, good about their schools, and good about their future.

Name _____

CONFIDENTIAL

Grade _____ Class _____

Date _____

BASIC SKILLS CHECKLIST (WOODWORKING)

The following is a list of the basic skills (reading, writing, math, verbal and visual communication) that the student should demonstrate an ability in for the purpose of employment or advanced training in the woodworking trades.

1.0 Verbal Communication: The student needs additional instruction in verbal communication if any of the items below are checked NO:

1.1 Yes ____ The student understands verbal instructions given by the teacher.

No ____ Example: Does the student use the guards on the circular saw after being instructed to do so by the teacher?

1.2 Yes ____ The student asks questions about verbal instructions or information not understood.

No ____ Example: Does the student ask questions about the operation of a machine when it appears that the verbal instructions were not understood?

1.3 Yes ____ The student is able to relay simple verbal instructions to another student.

No ____ Example: Is the student able to tell another student the proper procedure for setting up a dado head on the circular saw after they have learned how to perform the operation efficiently?

1.4 Yes ____ The student is able to verbally communicate with the teacher and other students.

No ____ Example: When a student wants permission to perform a certain operation on a machine, is the student able to make the teacher understand his/her request?

2.0 Writing: The student needs additional instruction in writing if any of the items below are checked NO:

2.1 Yes ____ The student is able to write basic instructions to self and others.

No ____ Example: If a student needs to remember a sequence of tasks to be performed, can the student write them in order after being told the tasks by the teacher?

2.2 Yes ____ The student is able to write the answers to questions.

No ____ Example: After a student has demonstrated that they can answer questions orally, can they write the answers on paper?

3.0 Reading: The student needs additional instruction in reading if any of the items below are checked NO:

3.1 Yes ____ The student is able to read and understand job related materials.

No ____ Example: Is the student able to read and understand safety rules and warnings (including the shop safety test); job applications, job orders, and operating instructions for machines?

3.2 Yes ____ The student is able to follow step by step procedures listed on instructional/job sheets.

No ____ Example: Is the student able to perform tasks in a sequence after being given a demonstration and procedure sheet to follow?

4.0 Math: The student needs additional instruction in math if any of the items below are checked NO:

4.1 Yes ____ The student is able to read a rule to increments of 1/16th in.

No ____ Example: Is the student able to pass a test which involves reading a rule; or is the student, as observed by the teacher, able to make accurate measurements during layout work?

4.2 Yes ____ The student is able to calculate the amount of material needed to manufacture an item.

No ____ Example: Is the student able to calculate the amount of wood needed for the front, back, and two sides of a drawer to be constructed?

4.3 Yes ____ The student is able to calculate board feet.

No ____ Example: Given the dimensions of a piece of lumber, is the student able to apply the board feet formula to obtain a solution?

4.4 Yes ____ The student can add and subtract fractions.

No ____ Example: Given the sizes of blades and chippers on a dado set, is the student able to add or subtract the number of chippers needed for a specific width of cut?

5.0 Visual Communication: The student needs additional instruction in visual communication if any of the items below are checked NO:

5.1 Yes ____ The student can understand working drawings and sketches.

No ____ Example: Can a student with the necessary woodworking skills construct a simple project from a sketch or drawing provided by the teacher?

5.2 Yes ____ The student can communicate to self and others with simple sketches or drawings.

No ____ Example: Is the student able to draw or sketch an item they wish to construct?

Identification made by: _____ Date _____

BASIC SKILLS VERIFICATION FORM

Student _____ Male____ Female____ Grade Level____

Teacher _____ Class _____ Date _____

The Basic Skills Check List (attached) for the above student indicates a need for instructional assistance in the basic skills (reading, writing, math, verbal or visual communication). The following verification and recommendations are made:

____ Lacks Reading Skills

____ Lacks Writing Skills

____ Lacks Mathematical Skills

____ Lacks Verbal Communication Skills

____ Lacks Visual Communication Skills

METHOD USED FOR VERIFICATION

Recent Test Scores:

Test	Score	Date

Other Verification Methods:

_____

_____

RECOMMENDATIONS

The following instructional assistance is recommended: _____

_____

Verification & Recommendations Made By: _____ Date: _____

Title: _____

_____

_____

FOLLOW UP

Action Taken: _____

Results: ____ Qualified for advanced training

____ Qualified for employment in the trade

____ Other _____

Certified by: _____ Date: _____

Teacher

THE RULER - THE MOST IMPORTANT TOOL IN WOODWORKING

(Reading a Ruler)

Woods Math 1

THE RULER - THE MOST IMPORTANT TOOL IN WOODWORKING

TEACHER MATERIALS:

1. CONCEPTS OF TECHNIQUE:

a. What SKILL will this technique teach?

This technique will teach the woodworking student the skills required to use a common ruler.

b. What student learning problem(s) prompted the development of this technique?

Many students are unable to read a ruler when they enter a high school woodshop.

2. TEACHER INSTRUCTIONS FOR THE USE OF THIS TECHNIQUE:

a. Give a simple test on how to read a ruler. Ruler Test I is included in this technique.

b. For those students who have difficulty reading the ruler, assign them the parent involvement technique for use in the home.

3. SUGGESTED RELATED ACTIVITIES:

After the student has completed this technique, you can have them use a ruler to measure several objects found in your classroom.

THE RULER - THE MOST IMPORTANT TOOL IN WOODWORKING

STUDENT MATERIALS:

1. STUDENT INSTRUCTIONS:

a. In any woodshop the ruler is the most important tool. You will need to know how to make accurate measurements in order to build all of your projects. It will even be necessary to use the ruler to set up the machines you will be using. A mistake in measuring can cost you both time and materials. This technique will help you learn how to read a ruler.

b. Study the Information Handout with your parent.

c. Have your parent give you Ruler Test II.

d. Have him/her check your answers when you are done.

1. If you answered all of the questions correctly, have him/her sign the bottom of the sheet. Return this page to the teacher.

2. If you missed some of the problems, review the ruler sheet again with your parent. Then take Test III. Have your parent sign the sheet. Return this page to the teacher.

2. STUDENT ASSIGNMENT:

Your assignment is found on STUDENT PAGES 2 - 5.

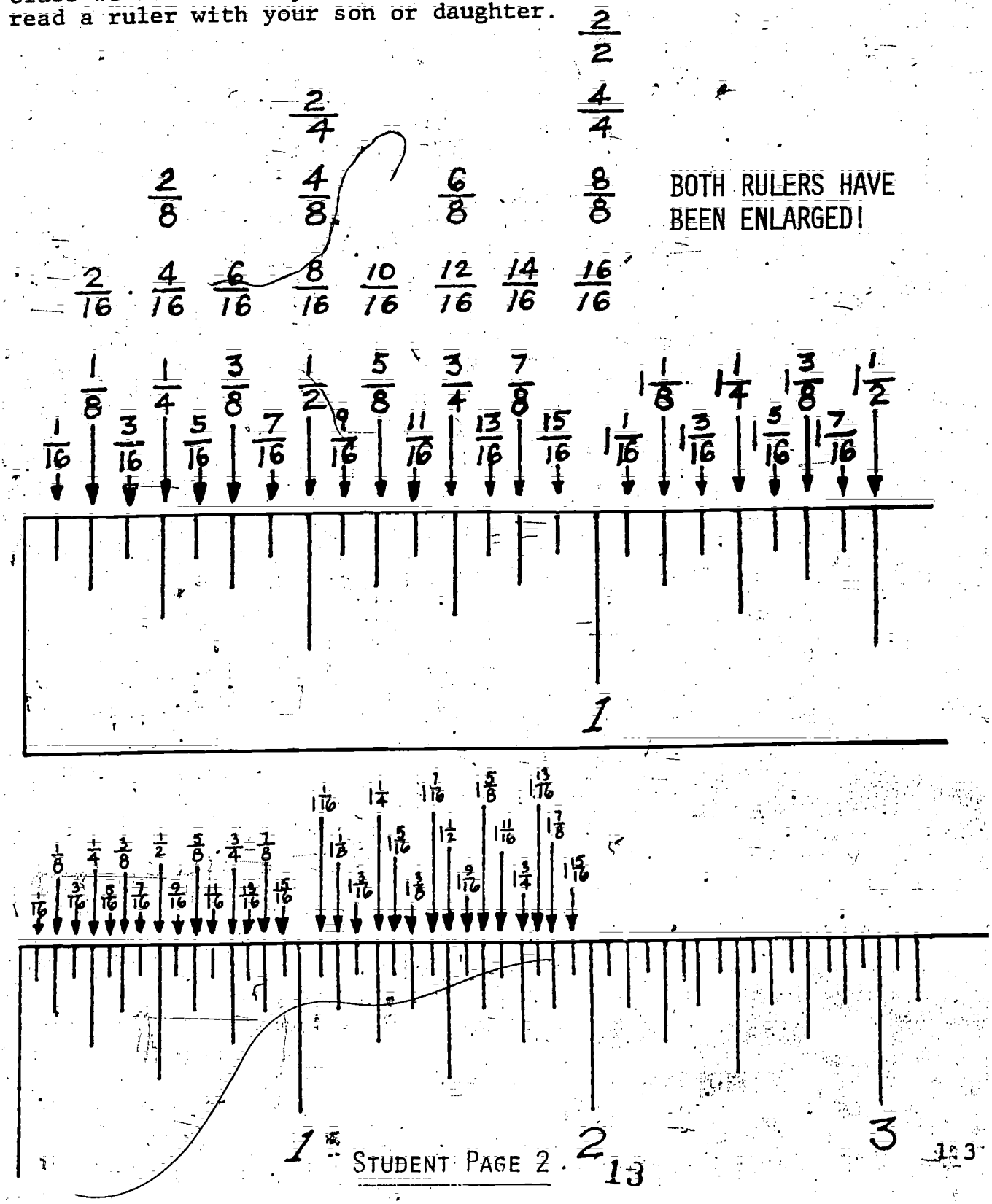
3. EXTRA THINGS THAT YOU CAN DO:

After you complete this technique, your teacher will have you measure several objects found in the classroom. This additional practice in using the ruler will help prevent a costly mistake on your project.

INFORMATION HANDOUT

THE RULER - THE MOST IMPORTANT TOOL IN WOODWORKING

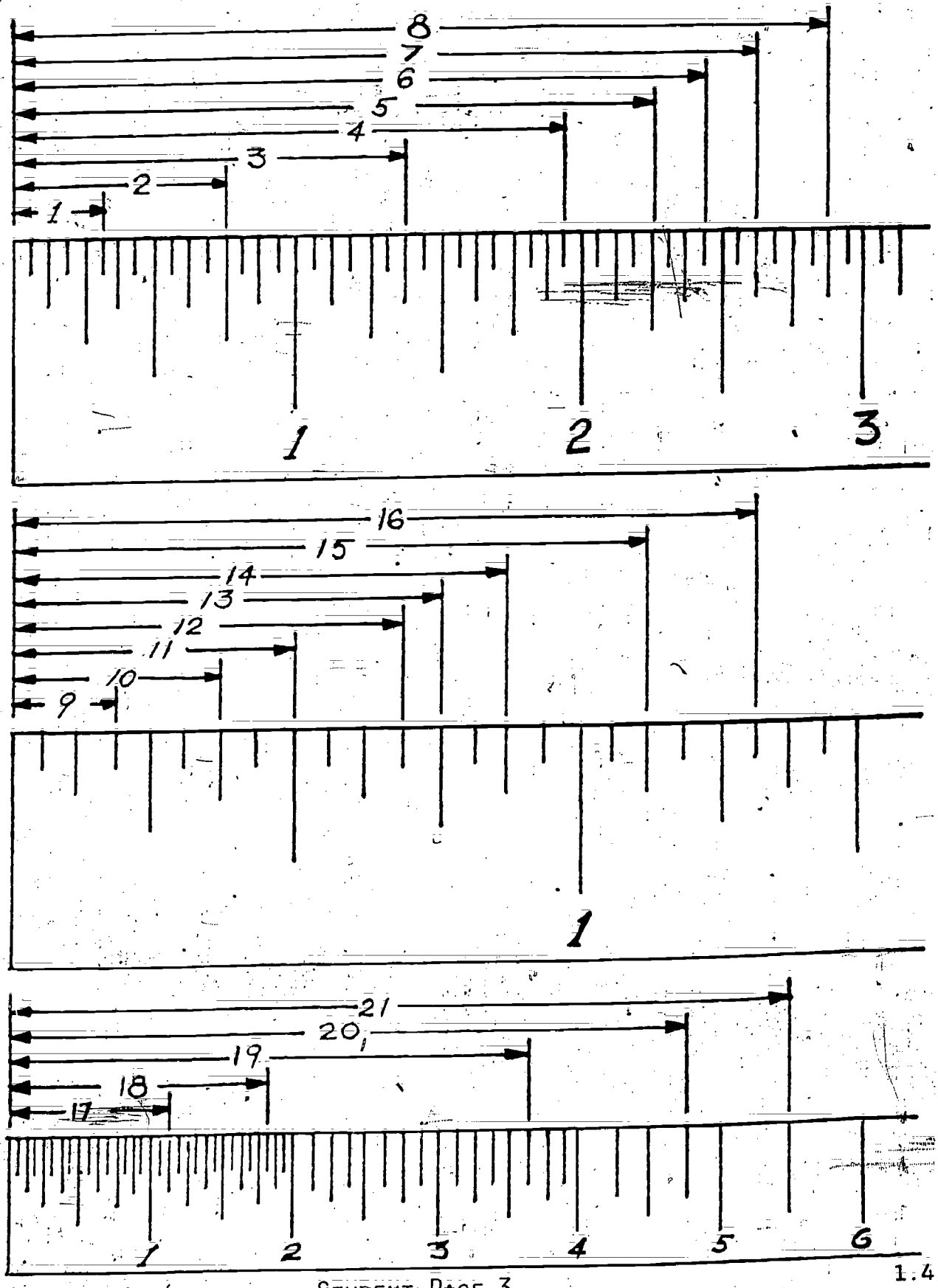
In order to reinforce the instruction that the teacher gives in class we would like you to take a few minutes to review how to read a ruler with your son or daughter.



RULER TEST I

Write the correct measurement on the lines provided to the left.

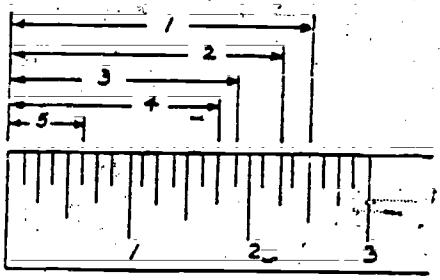
1_____
2_____
3_____
4_____
5_____
6_____
7_____
8_____
9_____
10_____
11_____
12_____
13_____
14_____
15_____
16_____
17_____
18_____
19_____
20_____
21_____

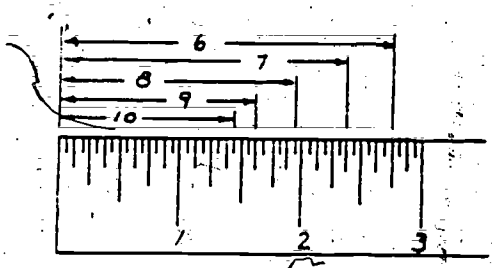


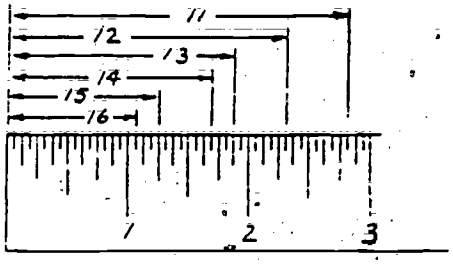
RULER TEST II

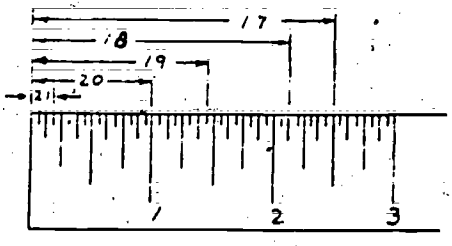
Write the correct measurement on the lines provided to the left.

1_____
2_____
3_____
4_____
5_____
6_____
7_____
8_____
9_____
10_____
11_____
12_____
13_____
14_____
15_____
16_____
17_____
18_____
19_____
20_____
21_____









Parent's Signature

RULER TEST III

Write the correct measurement on the lines provided to the left.

1_____
2_____
3_____
4_____
5_____
6_____
7_____
8_____
9_____
10_____
11_____
12_____
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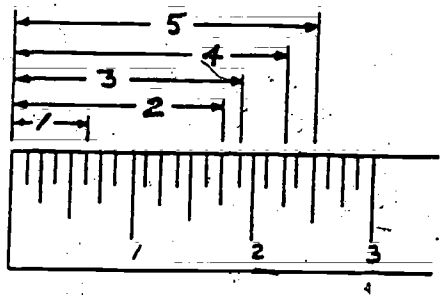
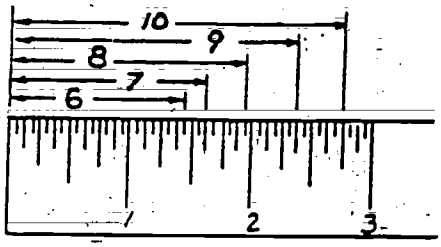
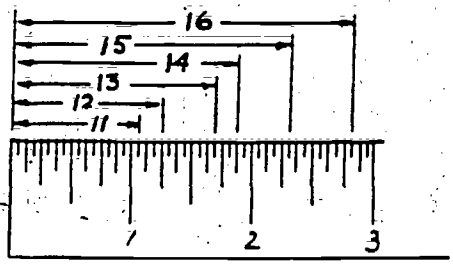
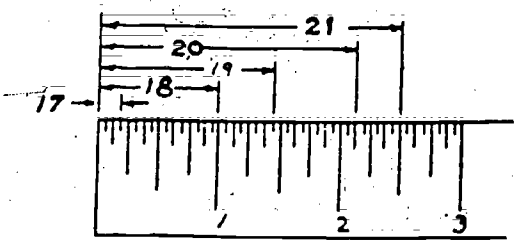
20_____
21_____









Parent's Signature

CALCULATING THE GREATEST NUMBER OF CUTS FROM HARDBOARD

(Multiplication & Division of Whole Numbers)

Woods Math 2

CALCULATING THE GREATEST NUMBER OF CUTS FROM HARDBOARD

TEACHER MATERIALS:

1. CONCEPTS OF TECHNIQUE:

a. What SKILL will this technique teach?

This technique will teach multiplication and division of whole numbers.

b. What student learning problem(s) prompted the development of this technique?

Students often have trouble getting the greatest number of cuts or pieces from a sheet of hardboard. Because hardboard is expensive, it is important that they learn to plan their cuts. This knowledge will reduce the amount of waste and lower the cost of a student's project.

2. TEACHER INSTRUCTIONS FOR THE USE OF THIS TECHNIQUE:

a. Give your regular presentation on how to calculate the maximum number of usable cuts from a piece of hardboard.

b. Be sure to point out that hardboard, unlike real wood or paneling, does not have a grain pattern. Therefore, cuts can be made by laying the pattern either vertically or horizontally to get the most pieces.

c. Give all the students a test on calculating the number of drawer bottoms or dust panels that can be cut from a certain size sheet of hardboard.

d. Identify those students who have difficulty understanding this concept and assign them this technique.

3. SUGGESTED RELATED ACTIVITIES:

After explaining the difference between real wood and hardboard have the students calculate the cuts from a sheet of plywood.

CALCULATING THE GREATEST NUMBER OF CUTS FROM HARDBOARD

STUDENT MATERIALS:

1. STUDENT INSTRUCTIONS:

a. Learning how to calculate the greatest number of cuts or pieces that you can get from a sheet of hardboard is important since hardboard is expensive. This handout will help you learn how to plan your cuts. This knowledge will reduce the amount of hardboard that you waste and lower the cost of your projects.

b. Study the INFORMATION HANDOUT.

c. Complete the Exercise on Calculating the Greatest Number of Cuts from Hardboard.

d. When you have answered all of the questions return your paper to the teacher to be checked.

e. If you are unable to complete the exercise you may take it home and ask one of your parents for help.

f. If you still want more help ask the teacher.

g. All papers must be returned to the teacher.

2. STUDENT ASSIGNMENT:

Your assignment is found on STUDENT PAGES 2-4.

3. EXTRA THINGS THAT YOU CAN DO:

Try finding the smallest size sheet of hardboard that would be required to make the drawer bottoms in a project that is under construction in your class.

INFORMATION HANDOUT

CALCULATING THE GREATEST NUMBER OF CUTS FROM HARDBOARD

Follow the steps shown in the sample below when you want to determine the greatest number of drawer bottoms or dust panels that can be cut from a sheet of hardboard.

Remember that hardboard does not have any grain pattern. This means that you can make your pieces go any direction on the sheet.

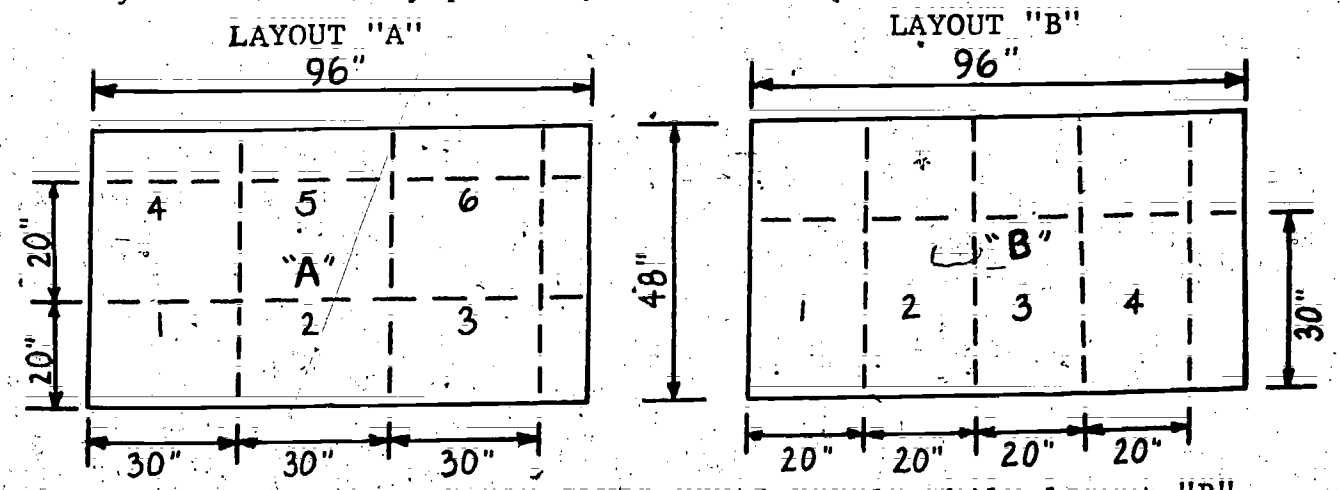
Don't forget that the saw (kerf) loss is 1/8 inch per cut. If you try to cut four 12 inch pieces from a 48 inch sheet the last piece will be 3/8 inch small.

SAMPLE PROBLEM:

You need to cut 20" x 30" hardboard panels.
How many pieces can you cut from a standard 48" x 96" sheet of hardboard?

METHOD #1

You can use a pencil or chalk to draw on the hardboard. This will let you see how many pieces you get.



As you can see, layout "A" gives you 6 panels while layout "B" gives you only 4 panels. This shows you why it pays to plan your cuts.

The problem with drawing directly on your hardboard is that after several tries your sheet will be covered with lines. This could cause you to make a costly mistake. This method is also very time consuming.

There is a much better way of calculating the greatest number of cuts from a sheet of hardboard. This method is shown on the next page.

CALCULATING THE GREATEST NUMBER OF CUTS FROM HARDBOARD

PROBLEM:

You need to cut 20" x 30" hardboard panels. How many pieces can you cut from a standard 48" x 96" sheet of hardboard?

METHOD #2

In this method you do not need to draw any lines on your sheet of hardboard.

To use this method you need to follow these steps:

a. How many times will 20" go into 48"? Answer = 2
(Forget about any remainder)

How many times will 30" go into 96"? Answer = 3

Now multiply 2 x 3 = 6 pieces

b. How many times will 30" go into 48"? Answer = 1

How many times will 20" go into 96"? Answer = 4

Now multiply 1 x 4 = 4 pieces

This shows that pattern "A" would give you the most pieces.

A simple way of writing Method #2 is shown below.

a. $\frac{48"}{20"} \times \frac{96"}{30"}$ (size of sheet) (divided by) (size of panels)

$2 \times 3 =$ (equals) 6 pieces

b. $\frac{48"}{30"} \times \frac{96"}{20"}$

$1 \times 4 = 4$ pieces

CALCULATING THE GREATEST NUMBER OF CUTS FROM HARDBOARD

EXERCISE:

Allow 1/8 inch loss per saw cut.

You are using hardboard so grain pattern does not matter.

Please show your work.

ANSWERS:

_____ 1. You need 30" x 40" panels.
How many can be cut from a 48" x 96" sheet?

_____ 2. You need 20" x 25" panels.
How many can be cut from a 48" x 96" sheet?

_____ 3. You need 15" x 30" panels.
How many can be cut from a 35" x 80" sheet?

_____ 4. You need 18" x 25" panels.
How many can be cut from a 40" x 80" sheet?

_____ 5. You need 10" x 15" panels.
How many can be cut from a 40" x 80" sheet?

_____ 6. You need 15" x 24" panels.
How many can be cut from a 45" x 72" sheet?

HOW TO CALCULATE FRAME LENGTH IN CABINET MAKING

(Addition and Subtraction of Whole Numbers & Fractions)

Woods Math 3

HOW TO CALCULATE FRAME LENGTH IN CABINET MAKING

TEACHER MATERIALS:

1. CONCEPTS OF TECHNIQUE:

a. What SKILL will this technique teach?

This technique will teach the skill of addition and subtraction of whole numbers and fractions.

b. What student learning problem(s) prompted the development of this technique?

Students usually have a problem calculating frame lengths because of the extra length needed for the joints.

2. TEACHER INSTRUCTIONS FOR THE USE OF THIS TECHNIQUE:

a. Make a presentation on how to calculate the lengths of boards for panel and frame construction.

b. Give all of your students the test on figuring frame lengths. (The test is included in this technique).

c. For those students that have problems with this pre-test, you can assign them this Parent Involvement Technique.

Reminder: Be sure to discuss how to add and subtract like and unlike fractions.

3. SUGGESTED RELATED ACTIVITIES:

Have the students figure the lengths of the frames and the length and width of the panels for the project that they are going to make.

HOW TO CALCULATE FRAME LENGTH IN CABINET MAKING

STUDENT MATERIALS:

1. STUDENT INSTRUCTIONS:

a. To make a cabinet with panel and frame construction you must be able to calculate the lengths of the board that are required for the frame. This exercise will help you learn to calculate these lengths.

b. Take this paper home and ask one of your parents to help you learn how to calculate frame lengths.

c. Study the INFORMATION HANDOUT and the sample problem.

d. With the help of one of your parents, complete the Exercise on Calculating Frame Length.

e. When you have answered all of the questions have your parent sign your paper and return it to the teacher to be checked.

2. STUDENT ASSIGNMENT:

Your assignment is found on STUDENT PAGES 2-5.

3. EXTRA THINGS THAT YOU CAN DO:

Try finding the lengths of the frames for the project you are going to make.

TEST

HOW TO CALCULATE FRAME LENGTH IN CABINET MAKING

Find the length of each of the boards used in the frames shown below. All of the dimensions are on the drawings.

1) Length A _____

   Length B _____

2) Length A _____

   Length B _____

   Length C _____

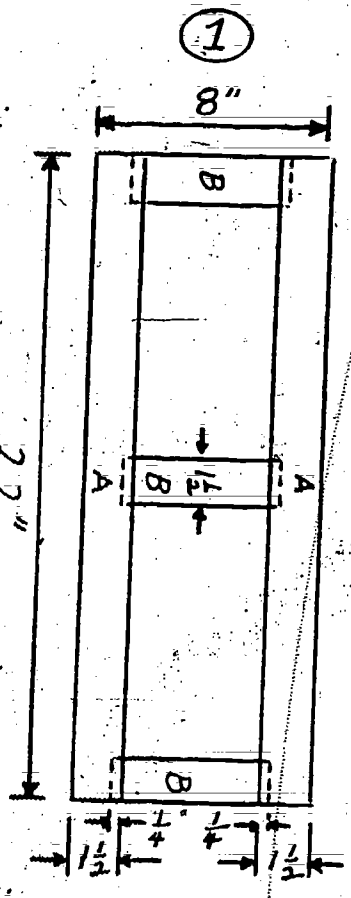
3) Length A _____

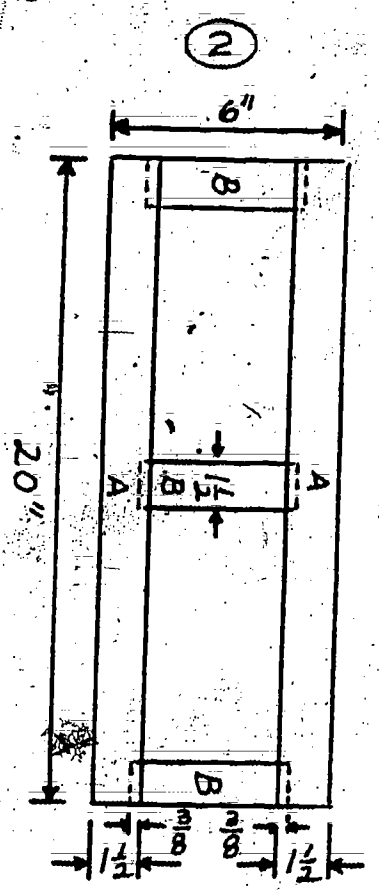
   Length B _____

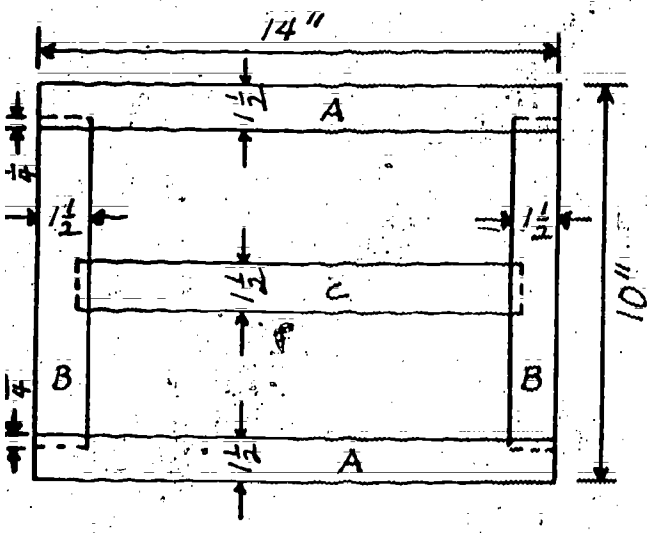
4) Length A _____

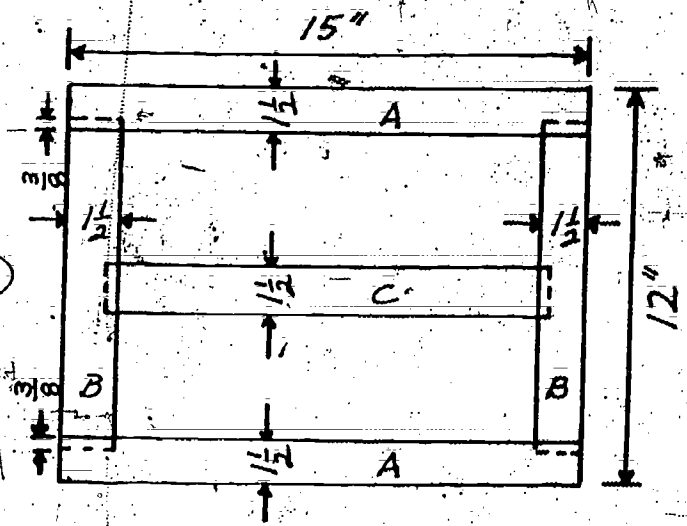
   Length B _____

   Length C _____









INFORMATION HANDOUT

HOW TO CALCULATE FRAME LENGTH IN CABINET MAKING

In order to reinforce the instruction that the teacher gives in class we would like you to take a few minutes to review this math skill with your son or daughter.

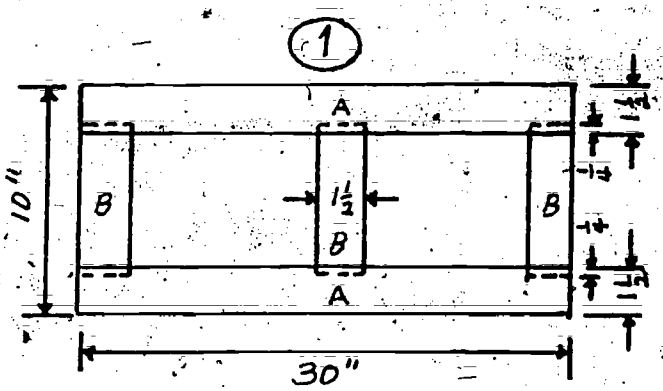
Today most cabinets have doors that are made with frame and panel construction. This eliminates some of the problems found when cabinet doors are made from solid wood. Solid wood tends to warp and change size with changes in the weather. Also, solid doors use more wood and they are very expensive.

Follow the steps shown below in the SAMPLE problems. They will help you calculate the lengths of the pieces of wood used to make the frames for a door panel.

SAMPLE #1

1) Length A 30"

Length B 7 1/2"



Calculating the length of board A is easy since the length of A is given as the length of the frame. A = 30 inches.

Finding the length of B is more difficult. B is not 10 inches, it does not go from end to end; 10 inches is the total width of the frame. To calculate the true length of B you must first find the distance between the two A pieces. A is 1 1/2 inches wide, so adding two sides gives you 3 inches (1 1/2" + 1 1/2" = 3"). Then 10" - 3" = 7". This 7 inches is the distance between the two A sides. This is still not the length of B. B extends 1/4" beyond each side of A. So you must add 7" + 1/4" + 1/4" = 7 1/2". This means the total length of frame B = 7 1/2 inches.

HOW TO CALCULATE FRAME LENGTH IN CABINET MAKING

Sample problem #2 is similar to #1. In problems #3 and #4 notice that the ends extends 3/8 inch.

The answers are given for these samples. Try working them and see if you get the same answers. If you do, then go on to the Exercise Page.

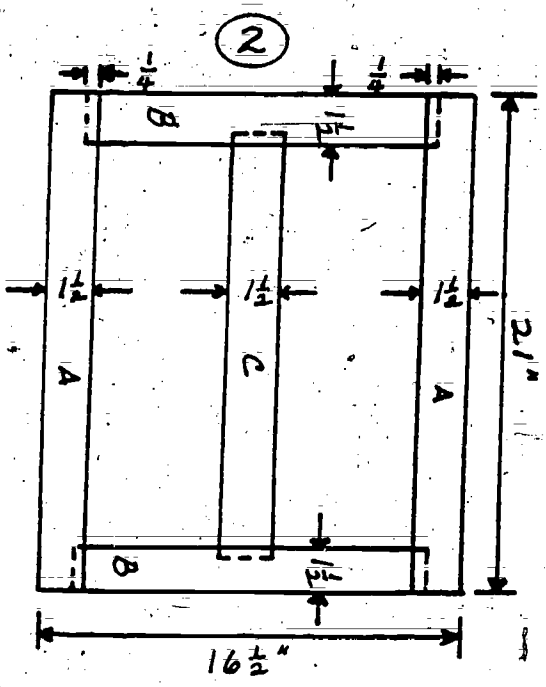
SAMPLE PROBLEM #2

Length A 21"

Length B 14"

Length C 18½"

Work problem here:

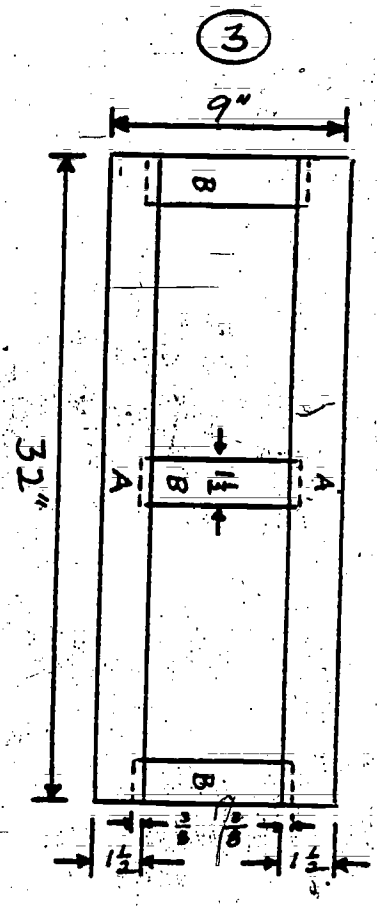


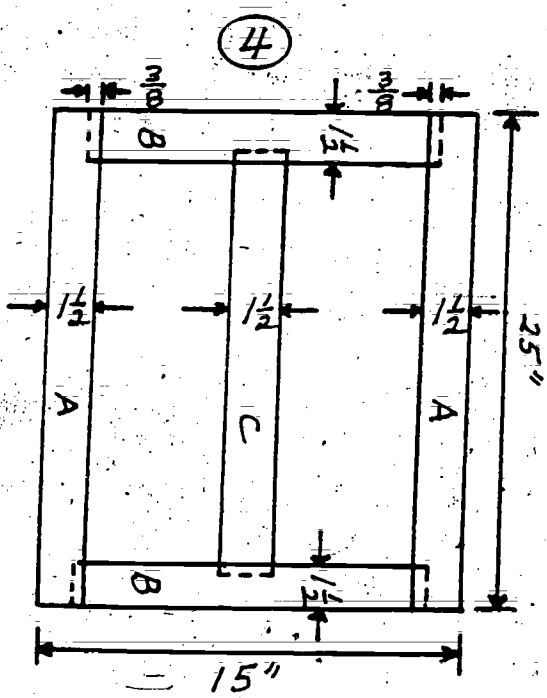
SAMPLE PROBLEM #3

Length A 32"

Length B 6¾"

Work problem here:





SAMPLE PROBLEM #4

Length A 25"

Length B 12¾

Length C 22¾

Work problem here:

EXERCISE

HOW TO CALCULATE FRAME LENGTH IN CABINET MAKING

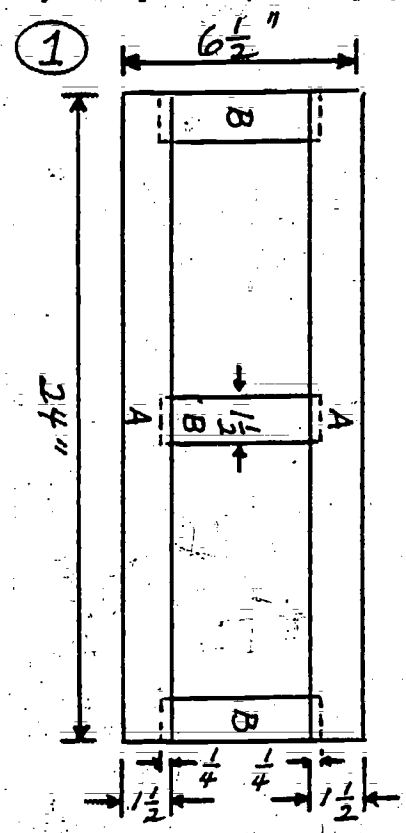
This exercise is similar to the test that you took in class. You are to find the length of each of the boards used in the frames shown below. All of the dimensions are on the drawings. These frames are the same type that you will be using when you build front door panels for your project.

Please have one of your parents help you work this exercise.

PROBLEM #1

Length A_____

Length B_____

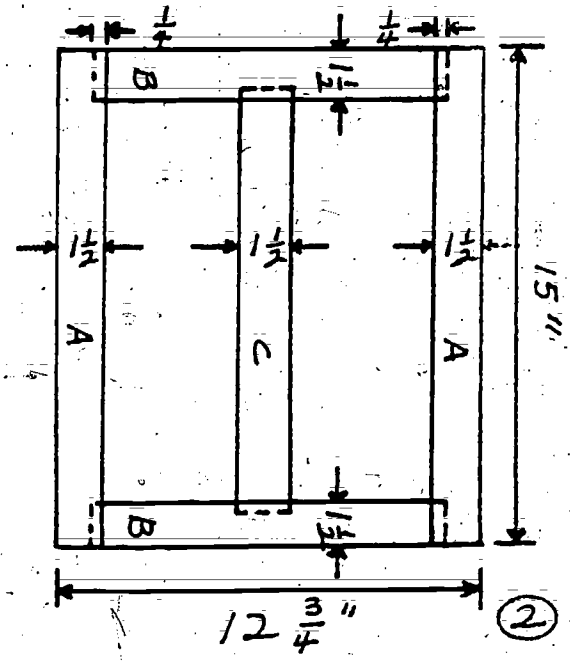


PROBLEM #2

Length A_____

Length B_____

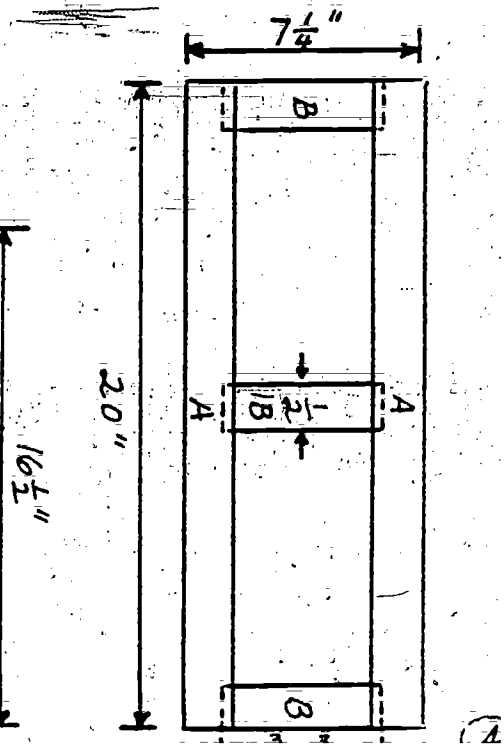
Length C_____



PROBLEM #3

Length A_____

Length B_____

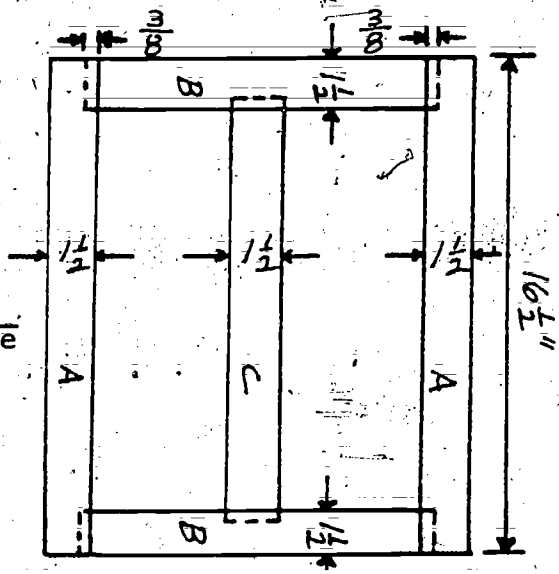


Problem #4

Length A_____

Length B_____

Length C_____



Parent's Signature

HOW TO FIGURE BOARD FOOTAGE

(Multiplication & Division)

Woods Math 4

HOW TO FIGURE BOARD FOOTAGE

TEACHER MATERIALS:

1. CONCEPTS OF TECHNIQUE:

a. What SKILL will this technique teach?

This technique will teach the skill of multiplication and division.

b. What student learning problem(s) prompted the development of this technique?

Students need to know how much their project will cost. First they must learn how to find the amount of board feet necessary for their project.

2. TEACHER INSTRUCTIONS FOR THE USE OF THIS TECHNIQUE:

a. Make your regular presentation on how to calculate board footage. Include a discussion on how to round off numbers.

b. Give all your students the test on board footage. (The test is included in this technique).

c. For those students who have problems with this pre-test, you can assign them the parent involvement technique.

3. SUGGESTED RELATED ACTIVITIES:

Have your students figure the total board feet required for their own projects.

HOW TO FIGURE BOARD FOOTAGE

STUDENT MATERIALS:

1. STUDENT INSTRUCTIONS:

a. Every time you build a project you will need to estimate the amount of wood you will need before you start your project. When you buy your wood you will need to accurately figure the board footage so you can determine the cost of your wood.

b. Take this board footage question sheet home and ask your parent(s) to help you learn how to figure board footage.

c. Study the INFORMATION HANDOUT.

d. With the help of your parents answer the questions on the Exercise Page. Have one of your parents sign the question sheet showing that they have helped you learn how to figure board footage.

e. Return the Exercise Page and all of your work sheets to the teacher.

2. STUDENT ASSIGNMENT:

Your assignment is found on STUDENT PAGES 2-4.

3. EXTRA THINGS THAT YOU CAN DO:

Try to find the number of board feet in the project you are working on.

TEST

HOW TO FIGURE BOARD FOOTAGE

Find the board feet in each of these problems.

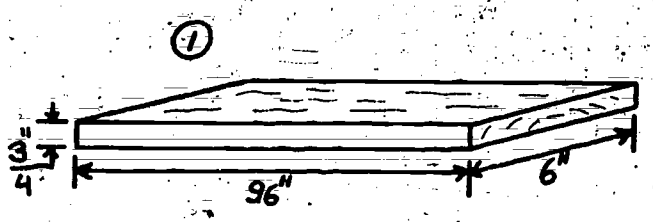
Be sure to change all dimensions to inches and divide by 144.

If the length is in feet you may want to use the ALTERNATE FORMULA and divide by 12. See formula below.

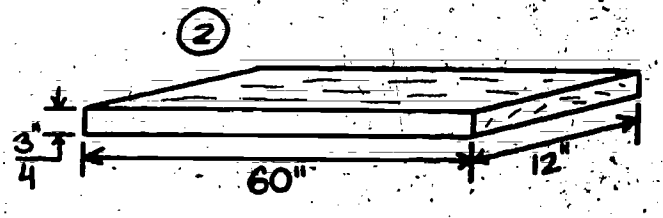
Remember that the thickness of a board one inch or less is counted as one inch. A board two inches or less, but more than one inch is counted as two inches.

$$\text{BOARD FEET} = \frac{\text{T" x W" x L"}}{144} \quad \text{OR} \quad \frac{\text{T" x W" x L'}}{12}$$

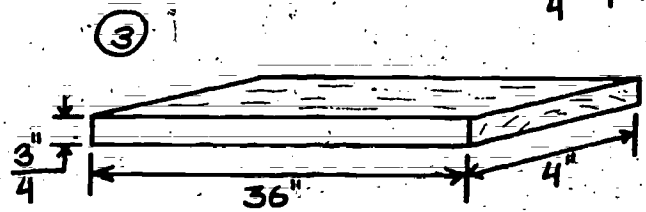
1. _____



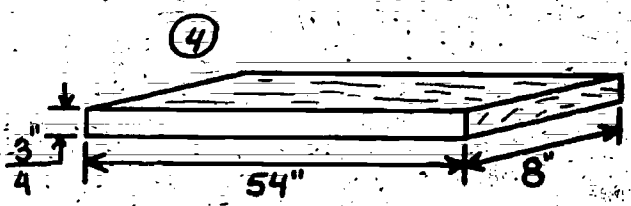
2. _____



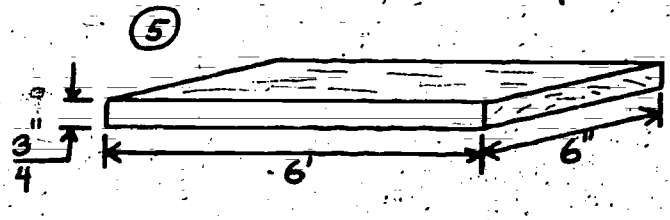
3. _____



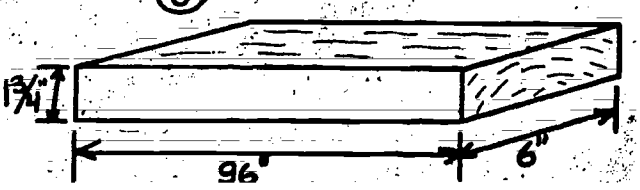
4. _____



5. _____



6. _____



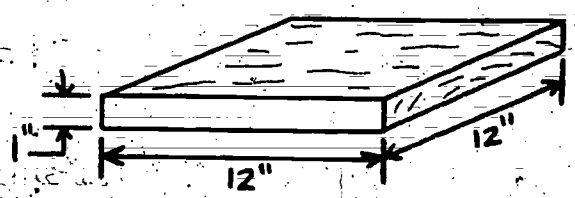
INFORMATION HANDOUT

HOW TO FIGURE BOARD FOOTAGE

In order to reinforce the instruction that the teacher gives in class we would like you to take a few minutes to review this math skill with your son or daughter.

Hardwood is sold by the board foot.

One board foot equals a board that is
1" thick by 12" wide by 12" long.



Not all boards are this exact size. In woodshop we need a method for finding board footage that will work for any size board. This method is the board footage formula.

FORMULA FOR FINDING BOARD FOOTAGE:

$$\text{BOARD FEET} = \frac{T" \times W" \times L"}{144}$$

To use this formula all dimensions must be in INCHES.

T = Thickness

W = Width

L = Length

All dimensions given in feet must be multiplied by 12 to change them to inches.

The thickness of a board one inch or less is counted as one inch. A board two inches or less, but more than one inch is counted as two inches.

ALTERNATE FORMULA:

If the THICKNESS and WIDTH are given in INCHES and the LENGTH is in FEET, you may use this ALTERNATE FORMULA.

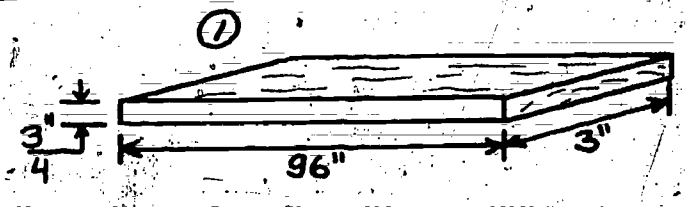
$$\text{BOARD FEET} = \frac{T" \times W" \times L'}{12}$$

PARENT AND STUDENT EXERCISE

HOW TO FIGURE BOARD FOOTAGE

SAMPLE PROBLEM

1. _____

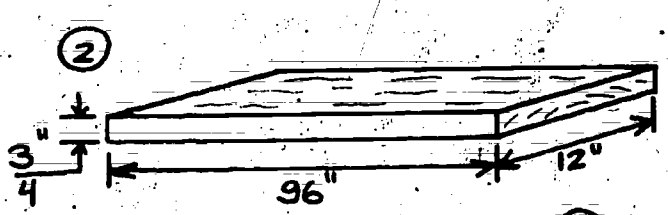


$$\text{BOARD FOOT} = \frac{\text{T" x W" x L"}}{144} = \frac{1 \times 3 \times 96}{144} = \frac{288}{144} = 2 \text{ Bd. Ft.}$$

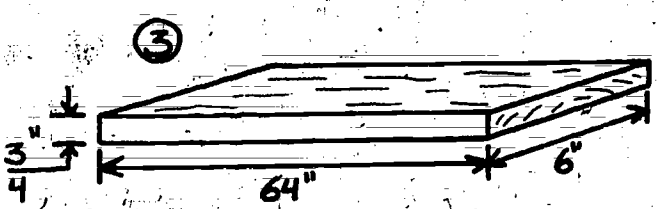
Since the thickness is 1" or less, you use 1" for the thickness. The width is 3" and the length is 96". Since the thickness, width and length are all in inches, you divide by 144.

FIND THE NUMBER OF BOARD FEET IN PROBLEMS 2 - 6. Use either inch or foot formula.

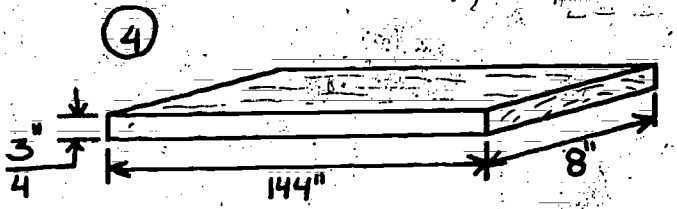
2. _____



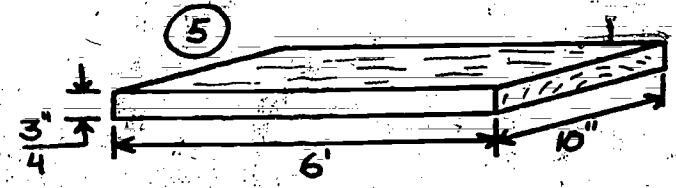
3. _____



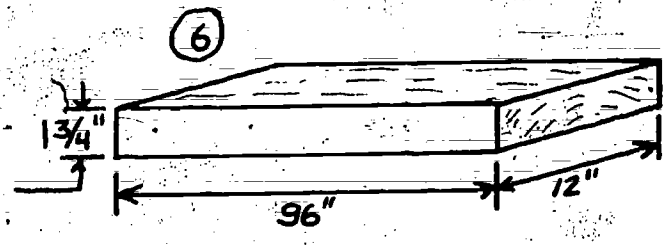
4. _____



5. _____



6. _____



_____ _____

PARENT'S SIGNATURE STUDENT'S NAME

HOW TO FIGURE THE COST OF HARDWOOD LUMBER

(Multiplication & Division of Whole Numbers & Decimals)

Woods Math 5

HOW TO FIGURE THE COST OF HARDWOOD LUMBER

TEACHER MATERIALS:

1. CONCEPTS OF TECHNIQUE:

a. What SKILL will this technique teach?

This technique will teach the skill of multiplication and division of whole numbers and decimals.

b. What student learning problem(s) prompted the development of this technique?

Many students are unable to figure the cost of lumber.

2. TEACHER INSTRUCTIONS FOR THE USE OF THIS TECHNIQUE:

a. Make your regular presentation on how to calculate the cost of hardwood lumber. Include a discussion on rounding off numbers and an overall review of how to calculate board footage.

b. Give all students the test on figuring the cost of lumber. (The test is included in this technique).

c. For those students who have problems with this pre-test, you can assign them this parent involvement technique.

3. SUGGESTED RELATED ACTIVITIES:

Have the students find the cost of lumber in their own projects.

HOW TO FIGURE THE COST OF HARDWOOD LUMBER

STUDENT MATERIALS:

1. STUDENT INSTRUCTIONS:

a. Take the "How to Figure the Cost of Hardwood Lumber" sheet home and ask one of your parents to help you learn to figure the cost of lumber.

b. Study the INFORMATION HANDOUT.

c. With the help of your parents review the steps for finding the cost of lumber and answer the questions on the EXERCISE PAGE found on Student Page 44

d. Have your parent sign the question sheet showing that they have helped you learn how to figure the cost of lumber.

e. Return the EXERCISE PAGE and all of your work sheets to your teacher.

2. STUDENT ASSIGNMENT:

Your assignment is found on STUDENT PAGES 2-4.

3. EXTRA THINGS THAT YOU CAN DO:

Try finding the cost of the lumber in the project that you are now building.

TEST

HOW TO FIGURE THE COST OF HARDWOOD LUMBER

In each of the problems below find:

A. BOARD FOOTAGE
B. TOTAL COST OF THE LUMBER

TOTAL COST OF LUMBER = NUMBER OF BOARD FEET X COST PER BOARD FOOT

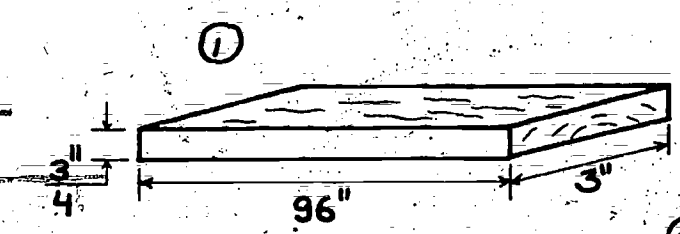
USE THE FOLLOWING COSTS PER BOARD FOOT:

Oak	$1.85 per bd. ft.	Cedar	$1.25 per bd. ft.
Maple	$1.45 per bd. ft.	Walnut ...	$2.75 per bd. ft.
Mahogany .	$1.35 per bd. ft.	Poplar ...	$1.00 per bd. ft.

1. POPLAR

A. _____

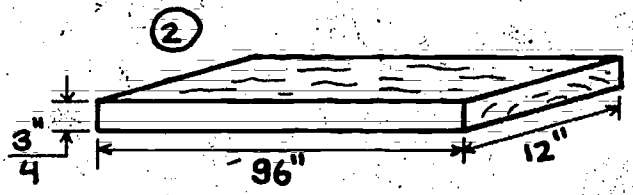
B. _____



2. OAK

A. _____

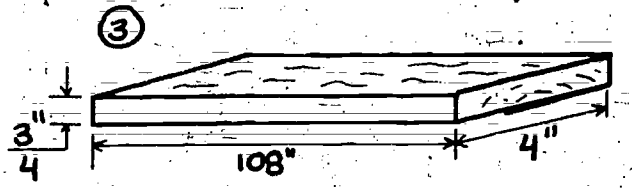
B. _____



3. MAPLE

A. _____

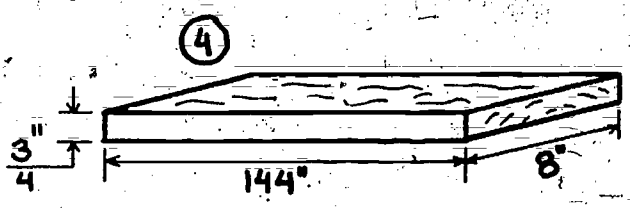
B. _____



4. MAHOGANY

A. _____

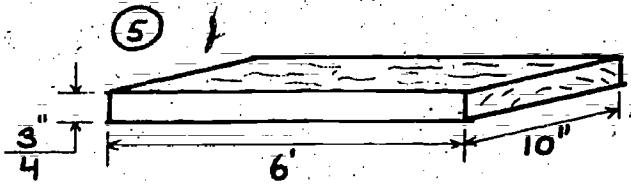
B. _____



5. CEDAR

A. _____

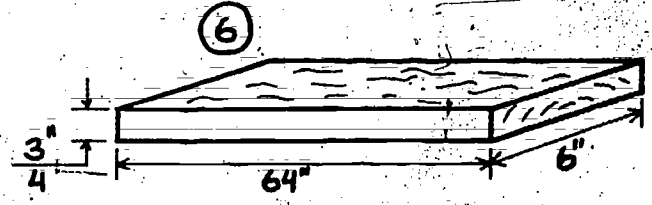
B. _____



6. WALNUT

A. _____

B. _____

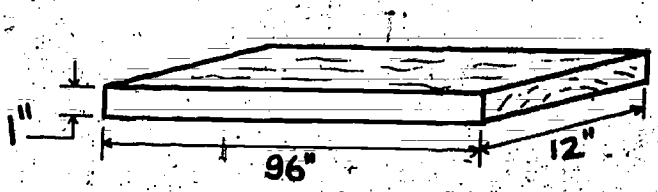


INFORMATION HANDOUT

HOW TO FIGURE THE COST OF HARDWOOD LUMBER

In order to reinforce the instruction that the teacher gives in class we would like you to take a few minutes to review this math skill with your son or daughter.

SAMPLE PROBLEM:



Find the cost of this Ash board at $1.95 per board foot.

A. First find the number of board feet in this board.

$$\text{Board Feet} = \frac{\text{T" x W" x L"}}{144} = \frac{\text{1" x 12" x 96"}}{144} = \frac{1152}{144} = 8 \text{ bd. ft.}$$

B. Now find the Total Cost:

Total Cost = Number of Board Feet x Cost of Board Per Board Foot

= 8 bd. ft. x $1.95 per bd. ft.

= $15.60

C. The total cost of this Ash board is $15.60.

PARENT AND STUDENT EXERCISE

HOW TO FIGURE THE COST OF HARDWOOD LUMBER

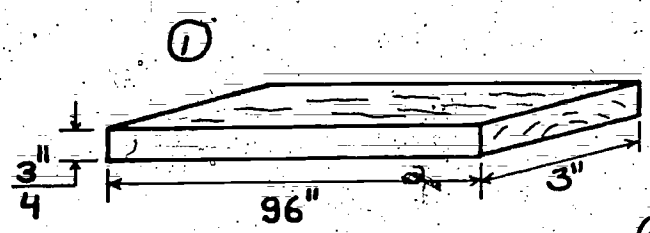
In each of the problems below find:

A. BOARD FOOTAGE
B. TOTAL COST OF THE LUMBER

Use "canceling" in your fractions. Save all your worksheets to show your teacher.
TOTAL COST OF LUMBER= NUMBER OF BOARD FEET X COST PER BOARD FT.

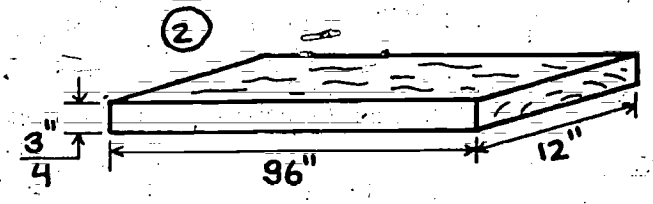
USE THE FOLLOWING COSTS PER BOARD FOOT:

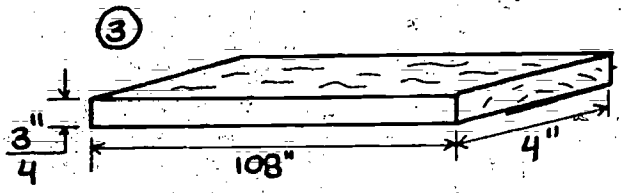
Oak....	$1.85 per bd. ft.	Cedar...	$1.25 per bd. ft.
Maple ..	$1.45 per bd. ft.	Walnut..	$2.75 per bd. ft.
Mahogany	$1.35 per bd. ft.	Poplar..	$1.00 per bd. ft.



1. POPLAR
   A. _____
   B. _____

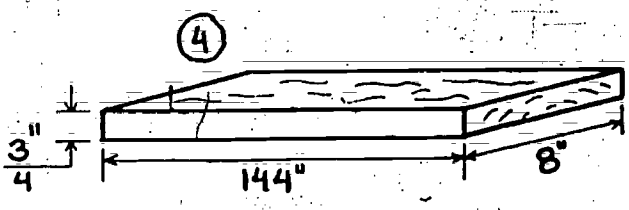
2. OAK
   A. _____
   B. _____

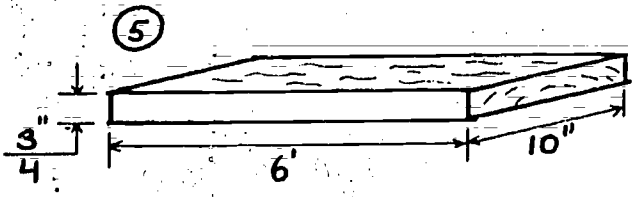




3. MAPLE
   A. _____
   B. _____

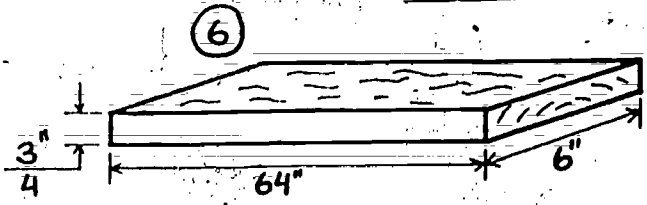
4. MAHOGANY
   A. _____
   B. _____





5. CEDAR
   A. _____
   B. _____

6. WALNUT
   A. _____
   B. _____



FINISHING MATERIALS - HOW TO FIGURE COST

(Multiplication & Division of Whole Numbers & Decimals)

Woods Math 6

FINISHING MATERIALS - HOW TO FIGURE COST

TEACHER MATERIALS:

1. CONCEPTS OF TECHNIQUE:

a. What SKILL will this technique teach?

This technique will teach multiplication and division of whole numbers and decimals.

b. What student learning problem(s) prompted the development of this technique?

Students need to know how much finishing material is required to complete their projects. The cost of this material must be figured and included in the total cost of the project.

2. TEACHER INSTRUCTIONS FOR THE USE OF THIS TECHNIQUE:

a. Make a presentation on how to calculate the area of rectangle.

b. Show how to find the total area by adding together the area of each of the individual rectangles.

c. Explain how to convert from square inches to square feet and how to round off numbers. When figuring these student problems round off to the nearest sq. ft. Example:

$$\frac{3124 \text{ sq. inches}}{144 \text{ sq. inches}} = 21.694 = 22 \text{ sq. ft.}$$

d. Explain how the amount of finish material needed can be found by dividing the total area to be covered by the area that the finish will cover per quart.

e. Show how the total cost is figured when the amount of finish needed is multiplied by the cost of the finish material.

3. SUGGESTED RELATED ACTIVITIES:

Have the students figure the amount of finish needed and the cost of various finishes for their project. 6.1

FINISHING MATERIALS - HOW TO FIGURE COST

STUDENT MATERIALS:

1. STUDENT INSTRUCTIONS:

a. All projects require some type of finish material to protect the wood. It is important that you can figure the amount of finish your projects will need. If you know the amount you need then you can also figure how much it will cost.

b. Study the INFORMATION HANDOUT. Complete the Finishing Materials - How To Figure Cost exercise found on Student Pages 3&4.

c. When you have answered all of the questions, return your paper to the teacher to be checked.

d. If you are unable to complete the exercise you may take it home and ask one of your parents for help.

e. If you still need more help, ask the teacher.

f. All papers must be returned to the teacher.

2. STUDENT ASSIGNMENT:

Your assignment is found on STUDENT PAGES 2-4.

3. EXTRA THINGS THAT YOU CAN DO:

Try to find the amount of finish material your project will require. Then figure how much this material will cost.

INFORMATION HANDOUT

FINISHING MATERIALS - HOW TO FIGURE COST

SAMPLE PROBLEM:

A BOARD 20" x 45" IS TO BE FINISHED WITH WATCO OIL. BOTH SIDES MUST BE FINISHED.

Watco Oil costs $5.00 per quart. One quart will cover 50 square feet.

The FORMULA for finding the cost of the amount of Watco Oil that you need is:

$$\text{Total Cost of Finish} = \frac{\text{Area to be finished in feet}}{\text{Area one can of finish will cover in feet}} \times \text{Cost of 1 qt.}$$

1. To figure the area you multiply the length times the width.

   Area = 20" x 45" = 900 square inches

2. Since you need to finish both sides multiply by 2.

   900" x 2 = 1800 square inches.

3. To convert square inches to square feet divide by 144.

$$\text{Area} = \frac{1800 \text{ square inches}}{144 \text{ inches}} = 12.5 \text{ feet}$$

4. Now you are ready to find the total cost of the finish.

   12.5 is the square foot area for both sides of the board
   50 is the amount of square foot area Watco Oil will cover per quart. $5.00 is the cost of Watco Oil per quart.

$$\text{TOTAL COST} = \frac{12.5 \text{ sq. ft.}}{50 \text{ sq. ft.}} = .25 \text{ qt. x } \$5.00 \text{ a qt.} = \underline{\$1.25}$$

5. The total cost is $1.25.

FINISHING MATERIALS - HOW TO FIGURE COST

Find the Total Area of the cabinet shown below.
You will need to finish all six outside surfaces.
The measurements are:

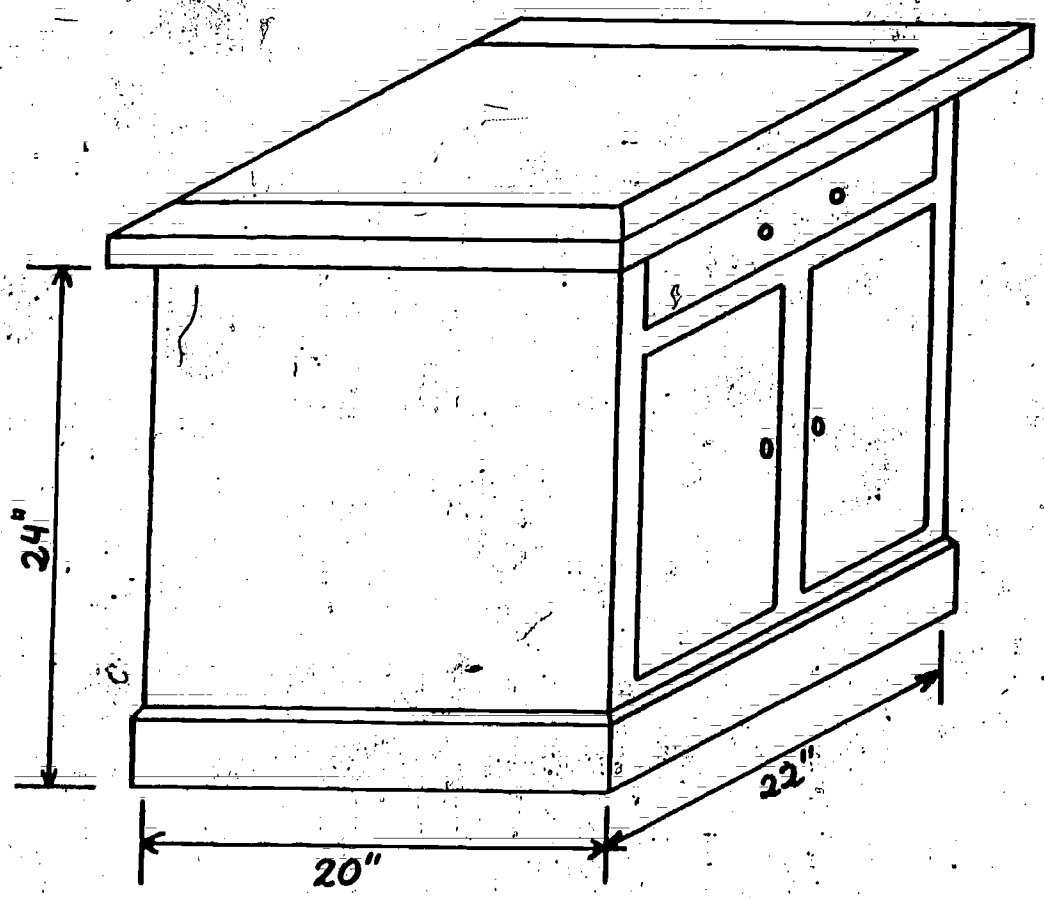
2 sides 20" x 24" = _____

Front and back 22" x 24" = _____

Top and bottom 22" x 20" = _____

Total square inches = _____

Total square feet = _____



FINISHING MATERIALS - HOW TO FIGURE COST

You have now figured the outside area of the cabinet (Student Page 3). The inside area will be about the same as the outside area. Therefore the total surface area of the cabinet is two times the outside area.

However, you are to stain only the outside of the project. Then, Watco Danish Oil Finish will be applied to both the outside and the inside of the cabinet.

Stain costs $6.50 per quart. It will cover 120 square feet.

Watco Oil costs $5.00 per quart. It will cover 50 square feet.

(Stain and Oil are both finishes).

$$\text{Total Cost of Finish} = \frac{\text{Area to be finished in feet}}{\text{Area the finish will cover in feet}} \times \text{Cost of finish}$$

QUESTIONS:

_____ 1. What is the outside area of the cabinet in square feet?

_____ 2. What is the inside area of the cabinet in square feet?

_____ 3. How much stain is needed?

_____ 4. How much will the stain cost?

_____ 5. How much Watco Oil is needed?

_____ 6. How much will the Watco Oil cost?

_____ 7. What will be the total cost of all finishing materials for this cabinet?

LATTICE MULTIPLICATION

(Multiplication of Whole Numbers)

Woods Math 7

LATTICE MULTIPLICATION

STUDENT MATERIALS:

1. STUDENT INSTRUCTIONS:

a. Fill in the "Times Table Chart". If necessary you can use this chart for reference when you do the rest of the assignment.

b. Read the worksheet "How To Do Lattice Multiplication".

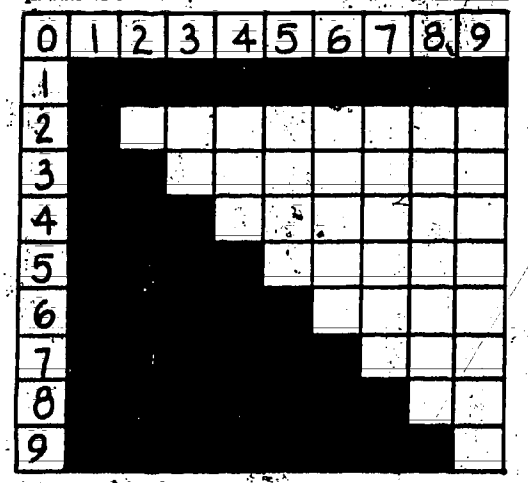
c. Work the problems using this method of multiplication.

2. STUDENT ASSIGNMENT:

Your assignment starts below and continues on STUDENT PAGES 2-5.

TIMES TABLE CHART

Fill in the missing numbers in each of the blank squares.

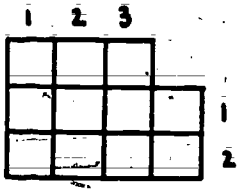


After you have filled in the chart check to see that you have the correct answers. You will find the correct answers in a math book or on a TIMES TABLE CHART like the one you find on the inside of a Peechee Folder.

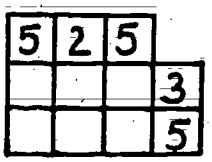
HOW TO DO LATTICE MULTIPLICATION

Step 1 Multiply 525 x 35

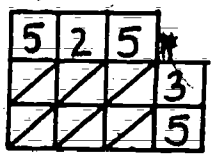
Draw 3 columns across the top and 2 columns down the side:



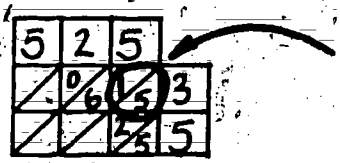
Step 2 Enter 525 across the top and 35 down the side.



Step 3 Draw diagonal lines to cut up each blank square.



Step 4 Multiply all the numbers filling in the blank squares. Some of this is done for you.

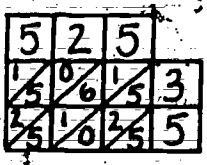


3*5 = 15
3*2 = 6
5*5 = 25

*If the answer is only 1 digit put "0" before it to fill in both parts.

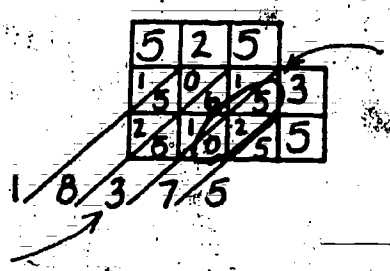
3 x 2 = 6 = 06

Step 5 Your problem should now look like this:



HOW TO DO LATTICE MULTIPLICATION

Step 6 The last step is to add the numbers on the diagonal, starting on the right.



*the sum is 18 - remember to carry the 1 to the next column (2+5+1equals 8)
The answer to 525 x 35 = 18,375

Do the following problem using the lattice method of multiplication. If necessary, you can look at the previous example.

MULTIPLY 53 x 21

Step 1 *hint: 2 columns across the top because it is a 2-digit number and 2 down the side because it is a 2-digit number.

Step 2 Fill in 53 x 21

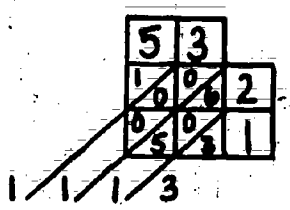
HOW TO DO LATTICE MULTIPLICATION

Step 3 Draw diagonal lines in the blank squares.

Step 4 Multiply 53 x 21

Step 5 Add the numbers on the diagonal.

Step 6 Your problem should look like this:

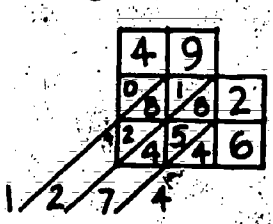


The answer to 53 x 21 = 1113

LATTICE MULTIPLICATION

Do these problems using the Lattice Method of Multiplication.

Example: 49 x 26



49 X 26 = 1274

1. 78 x 36

5. 27 x 69

2. 96 x 47

6. 89 x 32

3. 43 x 77

7. 57 x 34

4. 64 x 36

8. 83 x 24

EXTRA THINGS THAT YOU CAN DO:

Make up more problems of your own using larger numbers, example: 432 x 1976

USING FRACTIONS AND DECIMALS IN THE WOOD SHOP

(Converting Fractions to Decimals)

Woods Math 8

USING FRACTIONS AND DECIMALS IN THE WOOD SHOP

TEACHER MATERIALS:

1. CONCEPTS OF TECHNIQUE:

a. What SKILL will this technique teach?

This technique will teach the math skill of converting fractions to decimals.

b. What student learning problem(s) prompted the development of this technique?

Many students have forgotten this skill from lack of use or have not been taught this method of finding decimals.

2. TEACHER INSTRUCTIONS FOR THE USE OF THIS TECHNIQUE:

a. Present a lesson on the conversion of fractions to decimals. Include a discussion of rounding off numbers.

b. Have your students study the accompanying material and work the problems.

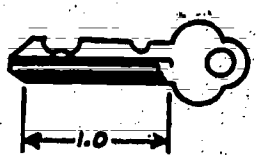
c. Check answers and review any problems that are incorrect.

3. SUGGESTED RELATED ACTIVITIES:

Give your students a list of decimals to convert to fractions.

USING FRACTIONS AND DECIMALS

IN THE WOOD SHOP



STUDENT MATERIALS:

1. STUDENT INSTRUCTIONS:

a. The materials in this packet will help you convert fractions to decimals.

b. Read and study the materials on STUDENT PAGE 2.

c. Work all problems found on STUDENT PAGE 3.

d. Have your teacher correct your answers.

e. Review your problems to see where you made mistakes.

2. STUDENT ASSIGNMENT:

Your assignment is found on STUDENT PAGES 2 AND 3.

3. EXTRA THINGS THAT YOU CAN DO:

Practice this skill with different fractions and let your teacher check your work.

USING FRACTIONS AND DECIMALS

IN THE WOOD SHOP

Let's start by using the fraction of $\frac{1}{8}$. Remember that the top number of a fraction is called the numerator and the bottom number of a fraction is called the denominator. To find the decimal equivalent, you divide the numerator by the denominator or if you forget the names of the numbers, divide the bottom number into the top number.

$\frac{1}{8} = 8\overline{)1}$

You now notice 8 does not divide into 1, so you add a decimal point behind the one and add three (3) zeros.

$8\overline{)1.000}$

Remember to move the decimal point up for your answer.

$8\overline{)1.000}$

Now you are ready to divide.

$$\begin{array}{r} .125 \\ 8\overline{)1.000} \\ \underline{8} \\ 20 \\ \underline{16} \\ 40 \\ \underline{40} \end{array}$$

You read your answer as one hundred twenty five thousandths.

USING FRACTIONS AND DECIMALS

IN THE WOOD SHOP

Find the decimal equivalents for the following fractions. (Write your answers so that they have three decimal places.)

1.) $\frac{1}{4}$ =

2.) $\frac{3}{8}$ =

3.) $\frac{7}{8}$ =

4.) $\frac{3}{4}$ =

5.) $\frac{1}{2}$ =

6.) $\frac{5}{8}$ =

7.) $\frac{3}{32}$ =

8.) $\frac{5}{16}$ =

9.) $\frac{3}{16}$ =

10.) $\frac{7}{32}$ =

11.) $\frac{9}{16}$ =

12.) $\frac{7}{16}$ =

THE FOLLOWING INDUSTRIAL EDUCATION BASIC SKILL INSTRUCTIONAL TECHNIQUES ARE AVAILABLE FROM:

VOICE (VOCATIONAL OCCUPATIONAL INFORMATION CENTER FOR EDUCATORS)
721 CAPITOL MALL
SACRAMENTO, CALIFORNIA 95814

"LEARNING TO READ AND WRITE THE AUTOMOTIVE WAY"
"LEARNING TO DO MATH THE AUTOMOTIVE WAY"
"LEARNING TO VERBALLY & VISUALLY COMMUNICATE THE AUTOMOTIVE WAY"

"LEARNING TO READ AND WRITE THE WOODWORKING WAY"
"LEARNING TO DO MATH THE WOODWORKING WAY"
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"LEARNING TO DO MATH THE METALWORKING WAY"
"LEARNING TO VERBALLY & VISUALLY COMMUNICATE THE METALWORKING WAY"

"LEARNING TO READ AND WRITE THE ELECTRONICS WAY"
"LEARNING TO DO MATH THE ELECTRONICS WAY"
"LEARNING TO VERBALLY & VISUALLY COMMUNICATE THE ELECTRONICS WAY"

"LEARNING TO READ AND WRITE THE DRAFTING WAY"
"LEARNING TO DO MATH THE DRAFTING WAY"
"LEARNING TO VERBALLY & VISUALLY COMMUNICATE THE DRAFTING WAY"